
Video-based kinetic analysis of calcification in live osteogenic human embryonic stem cell cultures reveals the developmentally toxic effect of Snus tobacco extract.

Journal: Toxicol Appl Pharmacol

Publication Year: 2019

Authors: Ivann K C Martinez, Nicole R L Sparks, Joseph V Madrid, Henry 3rd Affeldt, Madeline K M Vera, Bir Bhanu, Nicole I Zur Nieden

PubMed link: 30468815

Funding Grants: CSUSB Bridges to Stem Cell Research

Public Summary:

Epidemiological studies suggest tobacco consumption as a probable environmental factor for a variety of congenital anomalies, including low bone mass and increased fracture risk. Despite intensive public health initiatives to publicize the detrimental effects of tobacco use during pregnancy, approximately 10-20% of women in the United States still consume tobacco during pregnancy, some opting for so-called harm-reduction tobacco. These include Snus, a type of orally-consumed yet spit-free chewing tobacco, which is purported to expose users to fewer harmful chemicals. Concerns remain from a developmental health perspective since Snus has not reduced overall health risk to consumers and virtually nothing is known about whether skeletal problems from intrauterine exposure arise in the embryo. Utilizing a newly developed video-based calcification assay we determined that extracts from Snus tobacco hindered calcification of osteoblasts derived from pluripotent stem cells early on in their differentiation. Nicotine, a major component of tobacco products, had no measurable effect in the tested concentration range. However, through the extraction of video data, we determined that the tobacco-specific nitrosamine N'-nitrososornicotine caused a reduction in calcification with similar kinetics as the complete Snus extract. From measurements of actual nitrosamine concentrations in Snus tobacco extract we furthermore conclude that N'-nitrososornicotine has the potential to be a major trigger of developmental osteotoxicity caused by Snus tobacco.

Scientific Abstract:

Epidemiological studies suggest tobacco consumption as a probable environmental factor for a variety of congenital anomalies, including low bone mass and increased fracture risk. Despite intensive public health initiatives to publicize the detrimental effects of tobacco use during pregnancy, approximately 10-20% of women in the United States still consume tobacco during pregnancy, some opting for so-called harm-reduction tobacco. These include Snus, a type of orally-consumed yet spit-free chewing tobacco, which is purported to expose users to fewer harmful chemicals. Concerns remain from a developmental health perspective since Snus has not reduced overall health risk to consumers and virtually nothing is known about whether skeletal problems from intrauterine exposure arise in the embryo. Utilizing a newly developed video-based calcification assay we determined that extracts from Snus tobacco hindered calcification of osteoblasts derived from pluripotent stem cells early on in their differentiation. Nicotine, a major component of tobacco products, had no measurable effect in the tested concentration range. However, through the extraction of video data, we determined that the tobacco-specific nitrosamine N'-nitrososornicotine caused a reduction in calcification with similar kinetics as the complete Snus extract. From measurements of actual nitrosamine concentrations in Snus tobacco extract we furthermore conclude that N'-nitrososornicotine has the potential to be a major trigger of developmental osteotoxicity caused by Snus tobacco.

Source URL: <https://www.cirm.ca.gov/about-cirm/publications/video-based-kinetic-analysis-calcification-live-osteogenic-human-embryonic>